

Draft Individual Review Form

Proposal number: 2001-F212-1

Short Proposal Title: **Rainbow Trout Toxicity Monitoring.**

1a) Are the objectives and hypotheses clearly stated?

The proposal identifies and clearly states eight specific objectives to be achieved by this research investigation. The eight objectives follow a logical sequence designed to provide information on the magnitude, seasonal timing, and geographic distribution of potential contaminant exposure to salmon and steelhead within the Sacramento mainstem and major tributaries. The proposal hypothesizes that rainbow trout egg development can be used as a sensitive and reproducible toxicity test procedure for determining the effects of contaminants on salmonid reproduction. The initial steps of the proposed investigation are to develop and evaluate the ability of rainbow trout egg development as a predictive tool for toxicity testing. Only if the egg development techniques can be effectively developed and used to reliably predict toxicity under laboratory conditions could they then be applied to the broader scope of the proposed investigations to actually determine toxicity risk within various geographic areas of the Sacramento River system. The proposed investigations include both development of testing protocols and methods, in addition to the application of those methods to assess the risk of contaminant exposure within the river system.

1b1) Does the conceptual model clearly explain the underlying basis for the proposed work?

The proposal includes a conceptual model that primarily focuses on the relationship among proposal tasks rather than a conceptual model of the pathways, sources, and potential chronic and acute effects of toxic contaminants on salmonid egg and embryonic development. The conceptual model does not provide a scientific framework for hypothesis testing or elaborate on the factors to be evaluated as part of the proposed investigations. The conceptual model primarily focuses on the proposed elements of the investigation rather than the underlying basis for the toxicity evaluation.

1b2) Is the approach well designed and appropriate for meeting the objectives of the project?

The approach for conducting the proposed investigation, starting with the development of testing protocols using rainbow trout egg development, followed by validation of the proposed technique using various contaminants under laboratory conditions, and then the application of the proposed technique to evaluate potential contaminant risk using water collected from various locations within the Sacramento River system is a logical sequence for addressing the contaminant issue as outlined in the proposal. The proposed approach is founded on two underlying points, which include (1) the current fathead minnow toxicity testing program is not adequate for evaluating chronic or acute toxicity to developing salmonid eggs and embryos, which may provide a more sensitive biological indicator of contaminant risk, and hence additional protocols and methods need to be developed for such a testing technique, and (2) contaminants within various tributaries to the mainstem Sacramento River occur at sufficient concentrations and durations to result in significant mortality and adverse population level impacts to salmon and steelhead. With regard to this latter point, several major salmonid hatcheries exist within the system, including those located on Battle Creek, the Feather River, and the American River, which are sites proposed for ambient water sampling and testing under the proposed investigation (Figure 3). Salmon, steelhead, and in some instances rainbow trout are spawned, eggs incubated, and juveniles reared in these hatcheries. I am not aware of evidence suggesting significant contaminant-related mortality within these hatcheries, which utilize ambient water supplies from the various watersheds. These observations appear to be somewhat in conflict with the notion that there is substantial mortality occurring in key spawning areas within many of these major tributaries.

Another key element with regard to the approach is that to the extent toxicity does occur within salmon and steelhead spawning areas it may be related, as noted in the proposal, to stormwater runoff, which is likely to be a short-duration episodic-type event. The proposal does not address how such episodic events would be

addressed in the experimental design. In addition, the approach proposes using rainbow trout eggs as a representative indicator of toxicity to various races of Chinook salmon and steelhead. The proposed approach provides no validation that rainbow trout would be as sensitive to various toxicity constituents as would Chinook salmon, although because of the genetic similarities rainbow trout do appear to be an appropriate surrogate species for use in toxicity testing. Since many of the key species including fall-run and late fall-run Chinook salmon and steelhead spawn during the fall and winter months, while winter-run Chinook salmon spawn during the summer months, will a consistent supply of rainbow trout eggs be available for use in testing ambient water conditions from various portions of the watershed throughout the year? The proposed approach does not address these types of issues.

1c1) Has the applicant justified the selection of research, pilot or demonstration project, or a full-scale implementation project?

The applicant has justified the proposed investigations as a research project. Since a major component of the proposed investigation is the development of analytical methods and protocols for using rainbow trout egg development in evaluating toxicity and the laboratory validation of the methods and protocols, the investigation is appropriately characterized as research. If successful in developing these protocols and methods, the research would then be applied to evaluating potential toxicity within the watershed, which should also be considered basic research at this time.

1c2) Is the project likely to generate information that can be used to inform future decision making?

The project is likely to generate methods and protocols for toxicity testing, which are relevant to evaluating potential contaminant risk for salmonids within the Sacramento River watershed and would be applicable, as noted in the proposal, to similar types of investigations within other major tributaries to the Delta including the San Joaquin River system. In the event that the research is successful in documenting the magnitude, geographic extent, and seasonal timing of events contributing to salmonid toxicity to incubating eggs and that the source of such toxic contaminants can be identified, the research would provide a basis for future management decisions. The research would also be useful as a management tool if results clearly demonstrate that toxicity is not a significant factor adversely impacting salmonid reproductive success. Based on the currently available information there is no basis for evaluating the likelihood that the investigation will produce information to support these management decisions.

2a) Are the monitoring and information assessment plans adequate to assess the outcome of the project?

The monitoring and information assessment plans, including the identification of specific tasks outlined in the proposal, provide a good work plan for conducting the proposed research investigation. As noted above, in the absence of additional information it is difficult to assess the likelihood of various results being generated by this investigation. The proposed approach includes appropriate QA/QC procedures and sufficient detail regarding the types of analyses and validations to be performed to provide scientific credibility for the research results. As with most toxicity investigations, which rely on tests conducted under controlled laboratory conditions, results provide valuable information on potential risk, however the extrapolation of these results to assess population-level risk under field conditions is difficult. Salmonid eggs incubating within the mainstem Sacramento River and tributaries may be exposed to, and affected by, a variety of factors, which may either increase or decrease potential toxic response when compared to laboratory investigations. The experimental design, if successful, would provide useful screening-level information to identify potential impacts of contaminants on salmonid reproductive success, but may require additional site-specific field testing to fully evaluate the outcome of this investigation. In the event that the research investigation fails to identify toxicity as a factor affecting salmonid reproductive success, that would also be a valuable outcome of the investigation, however questions would likely continue to exist regarding

the methods, sensitivity of the tests, toxicity under various environmental conditions, and other factors before resource and regulatory agencies would be willing to accept this finding as definitive.

2b) Are data collection, data management, data analysis, and reporting plans well-described, scientifically sound and adequate to meet the proposed objectives?

The proposal presents a succinct description of the specific tasks to be performed, the specific types of data to be collected, data management, data analysis, and a brief description of the scope and content of the technical report to be prepared. The information appears to be scientifically sound and includes a number of points of peer review for the development of protocols, in addition to the ongoing oversight of a technical sub-committee. The proposal includes a QA/QC program, in addition to other standard protocols for ensuring that the results will be technically sound and adequate to meet the proposed objectives.

3) Is the proposed work likely to be technically feasible?

The proposed work does appear to be technically feasible in terms of developing the protocols and methods necessary for establishing rainbow trout egg development as a tool for evaluating toxic contaminant risk for salmonids. The extrapolation of these laboratory techniques to evaluate actual contaminant induced mortality affecting salmonid reproductive success in the field is substantially more challenging. Questions arise regarding the collection of surface water grab samples from various locations for use in laboratory-based toxicity tests to assess effects on rainbow trout egg development. Under actual field conditions salmon and steelhead egg development would be occurring in interstitial areas within gravel redds that may have substantially different water quality characteristics over the period of egg incubation than those encountered using grab sample collection techniques and laboratory-based incubation. For example, if a water quality sample were collected at the beginning of the first stormwater runoff pulse it may have substantially higher toxic contaminant concentrations and result in a substantially greater toxic risk assessment under laboratory conditions, when compared to salmonid eggs incubating for a period of weeks or longer under a variety of conditions within the field. Another factor that influences the ability to effectively interpret results of such experiments includes the effects of exposure of salmonid eggs to elevated water temperatures during spawning and egg incubation that may affect their sensitivity to chronic levels of contaminant exposure under field conditions, which would not be detected in laboratory tests where eggs are incubated under continuously optimal temperature conditions. The ability to effectively interpret and extrapolate results from the laboratory investigations to field conditions is a major technical challenge that will affect feasibility of interpreting and utilizing data from this research investigation for making management decisions. Technically, however, the proposed scope of work is feasible and can be accomplished using the methods and approach outlined in the proposal.

4) Is the proposed project team qualified to efficiently and effectively implement the proposed project?

The project team has extensive experience in conducting laboratory-based toxicity tests and evaluating the effects of various pollutants and contaminants. The team has experience in the application of toxicity testing results to water quality standards and the identification of various toxic constituents. The team has previously investigated the use of rainbow trout egg development as a toxicity testing tool and has experience in evaluating various end points for toxicity testing. The team has the necessary qualifications and capabilities to effectively conduct and complete the proposed investigation.

Miscellaneous comments

The proposed investigation has been developed within the context of a broader Sacramento River watershed program, and includes elements of public education and outreach in addition to technical review and coordination among a variety of inter-related watershed program elements.

If the proposal is funded, I recommend that milestones and budgets be established, to allow the research to proceed in a phased manner, with the first phase being development of the testing protocol and its validation prior to proceeding with any further field testing. I would also recommend that the sampling locations shown in Figure 3 be carefully reviewed and modified to exclude sample collections from locations where salmonid spawning and egg incubation does not occur. For example, water samples are proposed to be collected from the Sutter By-Pass, Colusa Drain, and mainstem Sacramento River downstream of the confluence with the American River, which although important water quality stations do not occur within areas where either salmon or steelhead are known to spawn.

Overall Evaluation Summary Rating	Provide a brief explanation of your summary rating
<input type="checkbox"/> Excellent <input type="checkbox"/> Very Good X <input checked="" type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Poor	<p>Research on the development of the rainbow trout egg toxicity testing protocol would benefit not only the CALFED program, but has application as part of Regional Water Quality Control Board point and non-point testing, NPDES compliance monitoring, and other applications. Development of a testing protocol, which uses the most sensitive lifestage of salmonids, described in the proposal as embryonic development, would be beneficial. As outlined above, I am concerned, however, regarding the applicability of the testing technique and the interpretation of the resulting data with respect to population-level salmonid reproductive impacts under actual conditions occurring within the mainstem Sacramento River and its tributaries.</p>